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LOWER CRETACEOUS NAUTILOIDS FROM TEXAS

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INTRODUCTION

Nautiloids from the Lower Cretaceous of north central Texas are very limited in numbers of species and individuals. A recent paper by Miller and Harris (1945) on North American Cymatoceratidae noted only three species of nautiloids from the Washita group of north central Texas. These are *Cymatoceras hilli* (Shattuck), *Cymatoceras locblichi* Miller and Harris, and *Paracymatoceras texanum* (Shumard). The present study is based on 13 specimens of immature nautiloids of the "pyrite faunae" of the Duck Creek, Pawpaw, and Grayson formations, plus three specimens of "calcareous" preservation from the Pawpaw formation. To the best of my knowledge this is the first description of nautiloids of the "pyrite faunae" from the Washita group. Adkins (1923, p. 57) records *Nautilus* sp. in his faunal list of the pyrite fauna from the upper Grayson formation, 4.5 miles south of McGregor, McLennan County, Texas. The pyrite fauna of the Pawpaw formation has been described by Adkins (1918) but he listed no nautiloids, and Böse (1927) has described numerous species of pyritized ammonites from the Grayson formation of north central Texas. Pyrite faunae are known from the Duck Creek, Denton, Pawpaw, and Grayson formations of the Washita group in north central Texas.

The pyritized nautiloids are all juvenile specimens of approximately one volution. They are tentatively placed in *Cymatoceras* and *Paracymatoceras* largely because they are associated with large mature species of these two genera. One of the specimens of calcareous preservation from the Pawpaw formation belongs in the genus *Angulithes*. This is the first reported occurrence of this genus in North America. There are recognized at the present 15 genera of nautiloids in the

Cretaceous. In all of the Cretaceous formations of North America only five genera of nautiloids are known, *Cymatoceras*, *Paracymatoceras*, *Eutrophoceras*, *Heminautilus*, and *Angulithes*.

The pyrite faunae of the Washita group have been considered as dwarfed by various authors (Scott, 1924, 1940, Winton, 1925). The question of dwarfism of these faunae has also been discussed by Kummel (1948). The nautiloids described here are juvenile individuals and are not dwarfed forms.

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SYSTEMATIC DESCRIPTIONS

CYMATOCERAS sp. indet.

Plate 1, figures 1-12; plate 2, figures 1-3

Eleven small immature specimens are available for study. The smallest specimen measures 12 mm. in diameter and the largest 21 mm. All of the specimens include approximately one volution of the conch, they are septate throughout, and no living chambers are preserved. In all of them the conch is nautiliconic, the whorl section is higher than wide, and the venter is rounded. In some of the specimens, portions of the venter are more sharply rounded. The number of camerae present ranges from 6 to 8. The most adoral sutures are strongly projected adorally forming a rounded ventral saddle, a broad concave lateral lobe and a small rounded saddle on the umbilical shoulder. The first suture is essentially straight; however, the second suture already shows distinctly the ventral saddle and the lateral lobe. A small annular lobe is present in the middle of the dorsal lobe (pl. 2, fig. 3). The siphuncle is small, rounded, and located very near the dorsum. All the specimens are internal molds and have no surface markings of any kind.

Small immature nautiloids are usually impossible to identify specifically and very difficult to determine generically. All the specimens studied came from the Duck Creek, Pawpaw, and Grayson formations and are part of the characteristic pyrite faunae of these formations.

There are also mature and relatively large specimens of calcareous preservation of *Cymatoceras hilli*, *Paracymatoceras texanum*, and *Paracymatoceras* sp. indet. Hyatt (1894) described and figured juvenile specimens of *Cymatoceras elegans?* (*Paracymatoceras texanum*), *C. deslongchampsianus*, *C. simplex?*, *C. radiatum*. The simple outline figures by Hyatt of the early whorls of the above species compare very favorably with the specimens figured here. The degree of involution, ontogeny of the suture, and shape of the cross section are quite similar. The writer has also compared his material with specimens of approximately the same size of various species of *Cymatoceras* from the Gault of England in the British Museum of Natural History.

Branco (1880) figured the first and second camerae of *Nautilus clementinus* d'Orbigny (= *Cymatoceras*). For *Nautilus* cf. *deslongchampsianus* d'Orbigny (= *Cymatoceras*) he figured the first four septa. The first two septa are essentially straight. The third septum shows a well developed ventral saddle with only a very shallow lateral lobe. The fourth septum has an even more pronounced ventral saddle and a wide lateral lobe. This fourth septum is very similar to the septa of the specimens of *Cymatoceras* described here.

Durham (1946, p. 432, pl. 63, figs. 3, 5, 7) described and figured a juvenile specimen of *Heminautilus etheringtoni* from the upper Aptian of Colombia. This specimen includes approximately one volution and measures 6 mm. in diameter. The whorl section is subtrigonal. The venter is slightly flattened and with a faint groove. This specimen with its subtrigonal outline compares favorably with those of *Cymatoceras* sp. figured on plate 1, figures 10-12.

Nautiloids in the Cretaceous of Texas are not abundant and representatives of only four genera, namely *Cymatoceras*, *Paracymatoceras*, *Eutrechoceras*, and *Angulithes* are known. In the Washita group *Cymatoceras* and *Paracymatoceras* have been known for a long time. The small immature specimens described here probably belong in *Cymatoceras*. Juvenile specimens of *Paracymatoceras* of comparable size already have very sinuous sutures. The adorally projecting suture could possibly develop into the sinuated suture of *Paracymatoceras* in more advanced ontogenetic stages. In respect to these two genera Miller and Harris (1945, p. 10) state that, "Presumably these two genera will be found to grade more or less into each other." When a more complete ontogenetic series of specimens can be assembled there should be no difficulty in determining the proper affinities of these specimens.

Occurrence. (1) Duck Creek formation, cut along Frisco R.R. about one mile north of Denison, Texas; (2) Pawpaw formation, halfway between Glen Garden Country Club and Sycamore Creek, 3 miles southeast of Fort Worth, Tarrant County (locality 723 of Adkins, 1918, p. 51); (3) Grayson formation, 4.5 miles south of McGregor and 100 yards east of the highway, McLennan County (locality 966 of Adkins, 1923, p. 52); $1\frac{1}{2}$ miles south of Bosqueville on the Belmont place, McLennan County; and at Bosqueville, McLennan County.

Repository. B.E.G. 297 (pl. 1, figs. 7-9), 3057 (pl. 1, figs. 4-6), 3002 (pl. 1, figs. 10-12; pl. 2, figs. 1, 2), 18750 (pl. 1, figs. 1-3), 3273 (pl. 2, fig. 3).

CYMATOCERAS HILLI (Shattuck)

This species has recently been described and figured by Miller and Harris (1945) and the description need not be repeated here. Two specimens from the Pawpaw formation are available. They are well preserved internal molds 70 mm. and 65 mm. in diameter, and have no surface markings of any kind.

Occurrence. Pawpaw formation, at Blue Mound, 2 miles southwest of Haslet, Tarrant County, B.E.G. loc. 219-T-1; and along east side of Mansfield Road, halfway between Glen Garden Country Club and Sycamore Creek, 3 miles southeast of Fort Worth, Tarrant County, B.E.G. loc. 219-T-17 (locality 723 of Adkins, 1918, p. 51).

Repository. B.E.G. 17414.

PARACYMATOCERAS sp. indet. 1

Plate 2, figures 6-7

A unique specimen forms the basis of this discussion. It measures 46 mm. in diameter, is partially crushed, septate throughout, and has the shell preserved. The conch is involute, compressed, and essentially smooth. The venter is broadly rounded, ventral shoulders distinct and rounded. The flanks are broadly convex and converge towards the venter. The maximum width of the whorl is just ventral of the umbilical shoulder. The umbilical shoulder is broadly rounded and the umbilical wall slightly convex, sloping at an angle toward the umbilicus which has the shape of a broad open funnel. The suture forms a broad rounded ventral saddle, a deep lateral lobe of approximately the same width as the ventral saddle, and a second smaller saddle on the umbilical wall. The siphuncle is not observable. The

surface of the shell has very faint ribs that are slightly sigmoidal on the flanks and form a deep sinus on the venter. The specimen is slightly crushed and several of the cracks in the shell follow along the line of the ribbing. The ribbing is at most very faint but is most distinct at the adoral part of the specimen.

Paracymatoceras differs from *Cymatoceras* only in the greater sinuosity of the suture. Miller and Harris (1945) suggest that these two genera may be gradational. Only one species of *Paracymatoceras*, namely *P. texanum* (Shumard), has been recorded from North America. That species is not uncommon in the Washita group of Texas. *Paracymatoceras* sp. indet. 1, differs from *P. texanum* primarily in its very subdued ribbing. It is undoubtedly an immature specimen which makes direct comparison difficult. Most of the specimens of *P. texanum* that have been collected in the Washita group of north Texas are internal molds of argillaceous limestone and few of the specimens have the shell preserved.

Spath (1927) and Miller and Harris (1945) have pointed out that the ribbing in the Cymatoceratidae can be very subdued. The suture of *Paracymatoceras* is very similar to that of *Hercoglossa* of the late Cretaceous and early Cenozoic. *Pseudaganides* is a late Jurassic genus also with a hercoglossid suture. In the Upper Triassic the Clydonautilidae are characterized by very sinuous sutures. Each of these nautiloid groups with sinuous sutures are probably independent developments and are not genetically related.

There are only five species of late Jurassic and Cretaceous nautiloids that can be placed in *Paracymatoceras* at this time; these are: *P. asper* (Oppel), the type species from Tithonian formations of Europe, *P. trichinopolitensis* (Blanford) from the Ariyalur group (Senonian) and *P. rota* (Blanford) from the Uttattur group (Albian) of south India, *P. texanum* (Shumard) from the Washita group of Texas, and *P. sp.* indet. 1, from the Pawpaw formation of Texas. The south Indian Cretaceous nautiloid fauna described by Blanford and Stoliczka (1861-66) and Spengler (1910) contains numerous cymatoceratids and also some species of *Hercoglossa*. As more Cretaceous nautiloids are discovered it will become increasingly difficult to differentiate those essentially smooth or weakly ribbed species of *Paracymatoceras* from *Hercoglossa*.

Occurrence. Pawpaw formation, from a pit of the Cobb brick yard, $\frac{1}{4}$ mile east of Sycamore Creek and 3 miles southeast of Fort Worth, Tarrant County (locality 716 of Adkins, 1918, p. 47).

Repository. B.E.G. 196 (pl. 2, figs. 6, 7).

PARACYMATOCERAS sp. indet. 2
Plate 2, figures 8-10; text figure 1

One small, immature specimen measuring 28 mm. in diameter warrants separate discussion. The specimen is a smooth internal mold preserved in the typical manner of the pyrite fauna of the Pawpaw formation. It is very involute, compressed, and with a well rounded venter. The suture forms a broadly rounded ventral saddle, and a deep lateral lobe followed by a smaller saddle. The siphuncle was not observed.

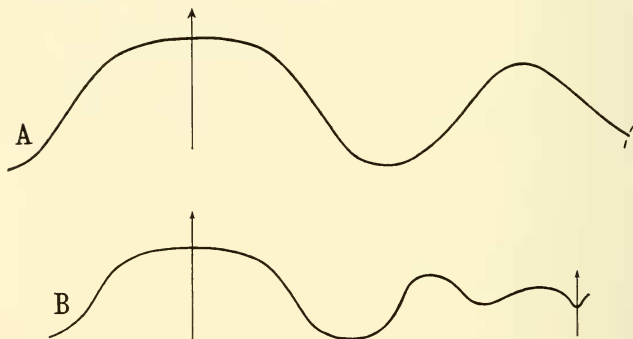


Figure 1. Diagrammatic representation of sutures. A, *Paracymatoceras* sp. indet. 2, at a diameter of about 24 mm., X 4; B, *Paracymatoceras* sp. indet. 3, at a whorl height of 6 mm., X 7.

I was at first inclined to place this specimen in *Hercoglossa* because it is perfectly smooth and has a typical hercoglossid suture, but possible pre-Danian Cretaceous species of *Hercoglossa* are known only from south India, and since *Paracymatoceras* sp. indet. 2 is associated with *P.* sp. indet. 1 and *P. texanum*, it is highly probable that *P.* sp. indet. 2 is a juvenile smooth specimen of *Paracymatoceras*. Very little is known of the ontogenetic development of ribbing in *Paracymatoceras*. The possibility exists, however, of this specimen being a juvenile *Hercoglossa*.

Loesch (1914) has described numerous species of Upper Jurassic nautiloids with very sinuous sutures. He includes figures of juvenile

specimens for *Nautilus schneidi* (pl. 1, fig. 5a, b, c), *N. ammoni* (pl. 3, figs. 5a, b, c), *N. strambergensis* (pl. 5, figs. 6a, b), and *N. sp.* (pl. 6, figs. 6a, b, c). In these four species of Upper Jurassic hercoglossids the sinuosity of the suture is very pronounced by the end of the first quarter whorl. On the mature whorls of these species the ventral saddle has a shallow lobe, likewise the ventral shoulders generally become angular. The specimen from the Pawpaw formation figured here is very similar to specimens of comparable size figured by Loesch (1914) of *Nautilus schneidi* (pl. 1, fig. 5c) and *N. ammoni* (pl. 3, figs. 4a, b).

Occurrence. Pawpaw formation, one-fourth mile south of the International and Great Northern railway bridge across Sycamore Creek, $4\frac{1}{2}$ miles southeast of Fort Worth, Tarrant County, B.E.G. loc. 219-T-23.

Repository. B.E.G. 17425 (pl. 2, figs. 8-10).

PARACYMATOCERAS sp. indet. 3

Plate 2, figures 4, 5; text figure 1

One small internal mold consisting of only two and one-half camerae is sufficiently distinct to be kept separate from the other specimens of *Paracymatoceras* described here. The specimen is from the pyrite fauna of the Pawpaw formation. The whorls measure 6 mm. in height and 8 mm. in width. The venter is broadly rounded, flanks convex, and the umbilical shoulders are sharply rounded. The suture has a broad ventral saddle and a deep rounded lateral lobe followed by a smaller saddle. There is a small annular lobe in the middle of the dorsal lobe. The small siphuncle is slightly dorsad of the center of the whorl. The internal mold is perfectly smooth.

This specimen differs from the other specimens of *Paracymatoceras* in having a more subquadrate outline. As with *P. sp. indet. 2*, this fragmentary specimen is thought to be a portion of a juvenile individual. Whether or not it is conspecific with the other two specimens of *Paracymatoceras* described above cannot be told. The general proportions of *P. sp. indet. 3*, are so different that they do not suggest specific identity.

Occurrence. Pawpaw formation, at headwaters of Buffalo Creek, 0.5 miles southeast of Blue Mound and 2.2 miles south of Haslet, Tarrant County, B.E.G. 219-T-2.

Repository. B.E.G. 17415 (pl. 2, figs. 4, 5).

ANGULITHES sp. indet.

Text figure 2

This is the first representative of this genus recorded from North America. The specimen is a somewhat weathered internal mold of five camerae and a portion of the living chamber. The flanks are moderately convex and strongly converge to a narrowly rounded venter. The greatest width of the whorl is just ventrad of the broadly rounded umbilical shoulder. The suture forms a narrowly rounded ventral saddle, a broad shallow lateral lobe which occupies the whole flank, and a small low saddle on the umbilical wall. The siphuncle is 3.5 mm. in diameter and located rather close to the dorsum.

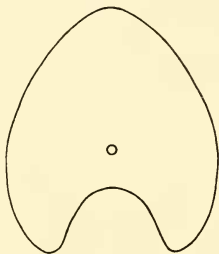


Figure 2. Diagrammatic cross section of *Angulithes* sp. indet., X 1.

The genus *Angulithes* Montfort (type species *Nautilites triangularis* Montfort) is characterized by a tightly coiled conch, strongly convergent flanks and a venter that is angular or narrowly rounded. Foord and Crick (1890, p. 404) point out that the venter on *A. triangularis* is alternately rounded and sharply angular. There are only five species of Cretaceous nautiloids that appear to belong in the genus *Angulithes*; these are *A. triangularis*, the type species, from Cenomanian formations of France and England; *A. tamulicus* (Kossmat) from the Danian of south India; *A. westphalicus* (Schluter) from the lower Senonian of Germany; *A. fleurbaeui* (d'Orbigny) from the Cenomanian of England and Europe; and *A. sp. indet.* from the Pawpaw formation of Texas. Due to the fragmentary nature of the specimen at hand direct comparison with the other species of this genus is difficult. It is most similar in general outline to the type species and to *A. fleurbaeui*. The specimen is too poorly preserved

to warrant a specific name but the record of a species of the genus *Angulithes* in North America is of interest.

Deltoidonautilus — type species *Nautilus sowerbyi* Wetherell — was proposed by Spath (1927) for Eocene nautiloids with nautilonic conchs and more or less sagittate cross sections with narrowly rounded to angular ventral zones. The sutures form narrowly rounded ventral saddles, rounded lateral lobes, and a small saddle near the umbilical wall. The siphuncle is located near the dorsum. Spath pointed out the similarity of whorl shape of *Deltoidonautilus* to *Angulithes*; however, he thought that *Angulithes* " . . . with its less sinuous suture-line was more closely allied, via *Ang. fleurbausi* (d'Orbigny) with the regular Nautiloid stock that produced *Pseudococeras* in the Cretaceous, as it had given rise before to the less specialized *Paracoceras* of the *calloricensis* type."

Examination of the various species of *Angulithes* from the European Cretaceous and the specimen from the Pawpaw formation described here shows no appreciable differences between *Deltoidonautilus* and *Angulithes*. At the time Spath proposed the genus *Deltoidonautilus* it was known only from the Eocene. The range of *Deltoidonautilus* is now known to be Paleocene to Oligocene (Miller, 1951). The few species of *Angulithes* range well throughout the Cretaceous. Because of the similarity of *Deltoidonautilus* and *Angulithes* the genus *Deltoidonautilus* should be suppressed and its species placed in the genus *Angulithes* which has priority.

Occurrence. Pawpaw formation, at hillside on north side of east-west road, 3 miles southeast of Haslet, Tarrant County, B.E.G. loc. 219-T-8 (locality 724 of Adkins, 1918, p. 51).

Repository. B.E.G. 17421.

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